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No. XXIV.

On Bleaching. By Thomas Cooper, Esq.—Read, June 20, 1817.

THE discovery of Scheele, that muriatic acid distilled over manganese, had, among other peculiar properties, that of destroying vegetable colours, was afterwards applied by Berthollet to the improvement of the common processes of bleaching.

Sometime about the year 1788, a meeting of the manufacturers of Manchester was called, to consider of the proposals of a Mr. Bonneuil or Bonjour, I now forget which, who offered to communicate a new mode of bleaching on receiving a reward for the discovery. Mr. Henry, Mr. Charles Taylor, (afterwards Dr. Taylor, Secretary to the Society of Arts at the Adelphi,) myself, and Mr. Jos. Baker, undertook to consider the subject and report. We met at Mr. Taylor's house, and having little doubt of the process being connected with the discoveries of Scheele, we distilled common muriatic acid over manganese, and found of course its effect of destroying most vegetable colours.

Considering that manganese was dirty, and the residuum worthless, I proposed using red lead in lieu of manganese, and we distilled the common muriatic acid over red lead, with equal effect. Some small portion of the muriat of lead, however, appeared by the result of our experiments to come over, and injure the whiteness of the cloth. I proposed to

obviate this, by using the common ingredients of muriatic acid, viz. common salt and oil of vitriol, on the supposition that a combination would be formed between the oil of vitriol and the lead, insoluble and incapable of sublimation. This proposal was subjected by us in common to experiment, and appeared to succeed.

The applicant for a reward on making the discovery, not finding the manufacturers of Manchester willing to close with his proposal, applied in London for a patent, which I was directed to oppose. The argument took place before the master of the rolls, Macdonald; Graham for the patent right, and myself in opposition; and the patent was relinquished. Mr. Graham's client was so mortified at his ignorance of a question which it was extremely difficult to render familiar to a gentleman of the bar, that he left the room, and I heard no more of him.

On my return to Manchester, my friend and neighbour, Mr. Joseph Baker, the owner of some oil of vitriol works, near Worsley, a few miles from Manchester, wrote me a note, informing me that he had made a great improvement on my proposal of manufacturing the bleaching liquor from red lead instead of manganese. He had added some muriatic acid to red lead in a common wine decanter, and stopping it tight with the stopper, he found the decanter strong enough to confine the effervescent liquor and vapour. Without making this known, we tried the process on a large scale of about 100 gallons, with perfect success.

Mr. Tenant soon after took out his patent for distilling the bleaching liquor with oil of vitriol, common salt and manganese; Mr. Rupp also, of Manchester, published his method, which, as to proportions, was much better than Mr. Tenant's. The best proportions appear to me to be *three* common salt, *two* oil of vitriol, *one and a half* manganese. The manganese was at that time imported from the neighbourhood of Exeter, at the rate of ninety shillings sterling, the ton.

Mr. Baker's process was so much superior, superceding at once all the use of retorts, distillery apparatus, fuel, receivers, alkali, lime, and almost all attendance, that I engaged with

him in the firm of Baker & Co., as bleachers. For three or four years, we bleached about 1800 calicoes a week, beside muslins, muslinets, and goods of every other description. The oxymuriatic acid *will not alone* produce a white colour; we used it as a *finish* at the close of the process of bleaching, with excellent effect and perfect safety. Indeed it superceded entirely the necessity of laying the goods down on the grass. The whole quantity daily wanted, was daily made by one of the partners; at first, without, and during the last year, with, the assistance of one confidential person. It was always used so weak, that no injury could arise to the cloth, and excepting in some accidental cases, attributable to the usual process of vitriolic souring, as well as to the bleaching liquor, no damage did occur.

I know not that the process has been used since I left Manchester in the year 1793. No one knew of it, or did use it before that period, excepting Joseph Baker & Co.* Five and twenty years interval since we were in the habit of using it, will justify the present publication, as the firm was dissolved about the year 1793, and the business discontinued. But from no considerations whatever arising either from the want of success or want of profit in the practice of this mode of bleaching; which I consider at present, as so superior in all respects to any other known to me as now in use, that injuring no one, I may venture to publish it for the consideration of those who may have occasion hereafter to bleach with the oxymuriatic acid or its combinations.

Three or four large cylindrical wooden vessels or barrels, (See Plate IX. fig. 7.) about five feet by four feet, made of oak, with staves 2 1-2 inches thick, (having a plug-hole on the top to admit a large funnel, through which the ingredients were poured in, and at the bottom of one of the ends a plug through which the liquor was let out) were supported on a strong frame or trestle in the middle room of a building ap-

* Mr. Hulme, who as a bleacher occupied the same grounds that Baker and Co. occupied a mile from Bolton, and where he carried on the business of a bleacher, so lately as 1816, informs me he never heard of this process.

propriated for the purpose. They rested on the frame, by gudgeons projecting from the end. The ends were strengthened by two strong cross plates of iron, to which the gudgeons were attached, and also a handle at one end to turn them round. Into each of these, 75lbs. of common salt, 40lbs. of oil of vitriol, and from 25 to 30lbs. of red lead were put, through the funnel. Then, the vessels were filled about three fourths with water. The plug on the top drove in, with a bit of cloth to tighten it: one man turned each vessel round for about ten minutes or a quarter of an hour. The liquor was then completely made, and left to settle. It was not stronger than to admit a wine glass full to be drank without much difficulty. The barrels were thus filled in the upper room through a hole in the floor; into which room no one entered but the person who poured in the ingredients. The barrels were turned round by a man in the middle room; they reached of course nearly up to the ceiling or the under part of the room above, where they were filled. They were permitted to stand an hour, if not wanted sooner, and then let off into the cuirs containing the goods to be bleached, down a pipe, which permitted the bleaching liquor to go down to the bottom of the cuir first, and then to rise up through the goods, previously deprived of moisture by being run through the squeezers.* The cuirs were covered by a close cover; the contents of one vessel was let off at a time, and the person who opened the plug and fixed the pipes, retired immediately to avoid the smell of the acid. The acid liquor was permitted to stay on the goods for twenty minutes after it had lost all odour of oxymuriatic acid, and had acquired the smell, taste and character of common muriatic acid: at this period, it emitted no offensive odour whatever.

* The common squeezers were cylinders made of any hard white wood. The squeezers for finishing the finer kind of goods, beside hollow copper cylinders with heaters withinside, were of the best kind of white paper, closely pressed and compacted by means of strong screws at the ends, and then accurately turned in a lathe.

These machines, wherein the liquor was made, would admit of being changed six or eight times a day if necessary, so that some thousand gallons might be daily manufactured with ease by one man.

We had no fuel, no furnaces, no retorts, no luting, no vessels capable of fracture, no alkali to neutralize the liquor, no series of wooden receivers; all of which constitute the apparatus actually in use at the present day! Half a dozen men, could have supplied the whole of the bleaching liquor necessary for the whole manufacture of the place at that time.

The sulphat of lead could be reduced by the common methods; we usually sold it.

The liquor was too weak and diluted to act injuriously on the goods: being weaker than the usual sourings with oil of vitriol and water. The spent liquor was thrown away, but I think might have been saved with profit.

The goods were very carefully washed at the dash wheel, after the process.

The plate accompanying this paper, (Plate IX. Fig. 7.) shews the barrel in which the ingredients were put; the frame or trestle, the funnel, inserted from the room above, (which is not a necessary but a convenient distribution of the apparatus) the covered *cuir* (pronounced *keer*,) containing the goods to be exposed to the action of the acid, the pipe going to the bottom, so that the oxymuriatic vapour should not be unnecessarily dissipated in the air; and the pipes fitting in to each other, when the liquor is required to be emptied from the barrels.

The other parts of the plate, fig. 8, 9, relate to the method now usually employed for the first part of the bleaching process, in France and in England. I have already said that no good, merchantable, white, can be made even on cotton, much less on linen goods, by means of the oxymuriatic acid alone. The goods must first be soaked for four and twenty hours, to soften the loose dirt, grease, &c.; this soaking should be

stopped, and the goods taken out, when air-bubbles appear in the tub, for that is the sign of incipient fermentation, which would rot the cloth. The goods are then to be taken out, and very well dashed; then squeezed and put into a tub, or cuir, to be percolated with an alkaline liquor. The old process was this: to a cuir containing about 250 calicoes weighing from ten to eleven pounds each, about seventy pounds of potash was taken: this was dissolved in a cast iron boiler placed even with the ground, or nearly so, with a fire underneath it. The potash being dissolved, a man with a ladle and long handle, poured the boiling hot solution on top of the cloth; the liquor percolated through the cloth (this is termed *bowking*)—ran out by a pipe at the bottom, into the boiler; so that for twelve hours, there was a constant current of boiling hot solution of potash, percolating through the mass of cloth; the man distributing it as evenly as he could. The cloth being taken out next morning, was dashed, squeezed, and again placed in a cuir, and in like manner bowked (bucked, from a bucking tub) that is, percolated with solution of alkali for twelve hours, in the proportion of thirty-five pounds of pearl ash to 250 pieces; dashed and squeezed as before. The pieces then undergo a souring in dilute sulphuric acid. Then dashed, squeezed, and a third time submitted to the same process of bowking with about fifteen pounds of pearl ash, and about five pounds of white soap: the next morning the pieces are taken out and dashed; and after being well squeezed, are submitted to the operation of the oxymuriatic bleaching liquor. Then dashed, dried, and made up. If necessary the oxymuriatic souring is repeated.

The expense of manual labour was afterwards superseded, by pumping the liquor out of the iron boiler, and discharging it on the surface of the mass of cloth in the cuir: but this method, though a saving of labour, was still very expensive, from the wear and tear of the pump-gear. The modern method is as follows. (See fig. 3 and 9.) An iron boiler is

employed, having a flange, or hollow rim on the outside, in which an iron or wooden tub or cuir, without a bottom, can be let in or fixed: this by tight packing can be made steam tight. On the inside of this iron boiler, there are three or four projecting knobs, on which an iron grate rests, so as to be moveable: which when placed upon its supports or knobs, within side the boiler, serves as a bottom to the cuir.

The quantity of ashes and water required, being put into the boiler, the grate is let down, and a pipe fixed in the middle of it reaching to within three or four inches of the bottom of the boiler, and at top, higher by an inch or two than the cloth. The cloth is arranged within side the cuir, resting on this moveable grate, and surrounding the pipe in the center; and is piled up to within five or six inches of the top rim of the cuir. A fire is made below the boiler, which is not more than one half or two-thirds full of liquor. The compact mass of cloth on the grating, scarcely permits any steam to pass through it: the heated steam thus confined, becomes highly elastic, presses upon the surface of the liquor, and forces it up the pipe to the top, where it escapes in a jet, which by means of a tin cover against which it is thrown, is evenly distributed over the surface of the cloth, percolates through it, and escapes through the grating of the moveable bottom that supports the cloth, into the boiler. The cloth by this means is exposed to a much greater degree of heat than in the old process, for the expansive force of the steam must be raised so as to force the liquor up the pipe, from near the bottom of the boiler below, to the surface of the mass of cloth above. Hence not near so much alkali is necessary in this method of steaming as in the old one, for it acts much more powerfully. To a cuir of cast iron that will hold about six hundred callicoes, they do not now use more than half a hundred weight of potash, in the first bowking: and the goods are prepared for the bleaching liquor in two bowkings, with an intermediate souring of

any dilute sulphuric acid, instead of three bowkings as before.

When the cloth is taken out, the grate is also taken out, with its pipe in the center ; water is poured in, and the boiler washed out, the washings being discharged by the waste pipe and cock below.

This method of bleaching, I understand, is introduced on a small scale into very many private houses in France, and no doubt with good effect.

Fig. 1.

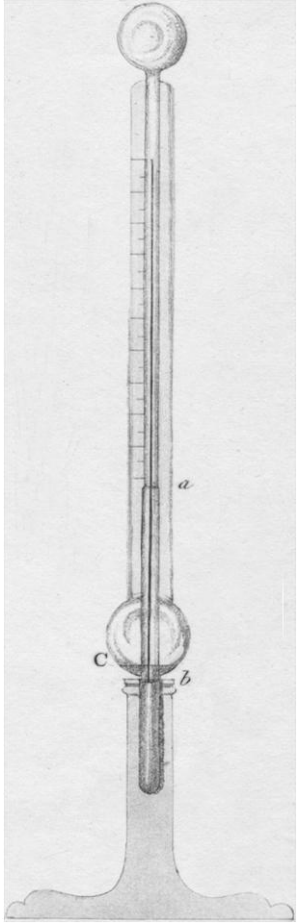


Fig. 2.

